REMARKS

Claims 1-12 are pending in this application.

In the Office Action, the Examiner indicated that claim 5 is allowable. Applicant gratefully acknowledges the Examiner's indication of allowable subject matter.

The Examiner rejected remaining claims 1-4 and 6-12 under 35 U.S.C. Section 103 as being obvious over Imai (JP 2000158643) in view of Ghozeil (US Patent No. 6375295). Applicant respectfully traverses the rejection.

The present invention according to claim 1 will be explained with reference to the specification and figures.

In today's inkjet printers, different waveform signals (referred to as recording modes in the specification) are used to achieve control for an individual dot such as tone control. In the embodiment shown in FIG. 2, there are four recording modes for an ink dot: none, small, medium and large. Actual waveform signals for these different recording modes are shown in FIG. 6, for example. Wave0_1, Wave0_2 and Wave0_3 respectively represent "small", "medium" and "large" ink tone modes. These waveform signals are typically sent on physically different signal lines. As shown in FIG. 1, these signal lines are contained in an FPC (flexible printed circuit cable) between a fixed printed circuit board 28 and the driver IC 11 of a movable printhead unit.

These waveform signals are time-wise staggered from one another to avoid the problems of crosstalk or overcurrent that may result from simultaneously driving a large number of actuators in the printhead unit (compare, for example, wave0_1 to wave3-1 in FIG. 6).

However, if this staggered technique is applied to a printhead unit having a very large number of nozzles such as in a color recording head unit, a great number of physical signal lines are required between the fixed printed circuit board and the movable printhead unit. For example, if there

are three signal lines (see three lines representing wave0_1, wave0_2 and wave0_3 in FIG. 3) for the "recording element group" of yellow color, an additional nine signal lines are required for the other recording element groups (e.g., the other three colors): magenta, cyan and black. This means a total of twelve signal lines need to be included in the flexible printed circuit cable running between the PCB 28 and the driver IC 11 of the color printhead unit. The additional signal lines result in difficulty of routing the signal lines and a substantial increase in manufacturing cost (see paragraph 6 of the present specification).

According to the invention of claim 1, these problems are solved by having only a limited number of signal lines for one recording element group (e.g., three lines for yellow) and generating the other signal lines for the other recording element groups (e.g., the other nine signal lines for magenta, cyan and black) locally in the printhead unit by drive signal providers based on the received signal lines. This is done by using a delay circuit that delays the waveform signals received by a waveform signal receiver.

As an example, FIG. 3 shows a waveform signal receiver 12a attached to only three signal lines from the fixed PCB 28. The three signal lines respectively contain three waveform signals that represent the three recording modes (small, medium and large) for one group of recording elements (all nozzles DR0 through DR74 for yellow). The delay circuits 17, 18 and 19 are used to appropriately delay the three waveform signals for yellow to derive the other nine waveform signals for the other recording element groups (magenta, cyan and black) (emphasis added).

Thus, the flexible printed circuit cable attached to the waveform signal receiver 12a contains only three signal lines for the waveforms rather than the twelve lines that would have been required in the prior art.

This advantageous feature of deriving the waveform signals for other recording element groups from the signal

lines for one recording element group is recited in claim 1 as:

a first waveform signal receiver that receives, through signal lines, a plurality of waveform signals representing various recording modes;

"a first drive signal provider that . . . supplies the drive signals to one of recording element groups"

"a first delay circuit that delays the waveform signals received by the first waveform signal receiver"

"a second drive signal provider that generates drive signals on the basis of the waveform signals delayed by the first delay circuit, and supplies the drive signals to another recording element group" (emphasis added).

In the Office Action, the Examiner equates first and second drive signal providers in claim 1 to first and second selection means 33 of FIG. 3 in Imai. Applicant respectfully disagrees. As recited in claim 1, each drive signal provider generates waveform signals for a "recording element group". The recording element group relates to a group of nozzles/ink chambers. For example, each group may represent the entire group of nozzles that print a particular color (see paragraph 15 of the present specification). In that example, there are four recording element groups: black, cyan, magenta and yellow (see paragraph 14).

By contrast, each selection means 33 of Imai only generates waveform signals for one nozzle. Thus, Imai as interpreted by the Examiner does not generate waveform signals for one of "recording element groups".

The Examiner then uses the Ghozeil reference as teaching the first delay circuit and generation of drive signals on the basis of the delayed waveform signals. Applicant respectfully disagrees.

In Ghozeil, the fire signal generating logic 15 (see FIG. 3 and col. 3, lines 10-20 of Ghozeil) generates a single "'global' firing signal" that is the same for all ink ejection. By contrast, claim 1 recites "a plurality of

waveform signals representing various recording modes". As the single fire signal of Ghozeil can only represent a single "recording mode", the fire signal generating logic 15 of Ghozeil cannot represent "various recording modes" as recited in claim 1.

As a consequence, the "delay element 56" of Ghozeil delaying only a single waveform signal cannot delay a plurality of waveform signals that represent "various recording modes" as recited in claim 1.

When Ghozeil is combined with Imai, the combination still cannot delay a "plurality of waveform signals representing various recording modes" as claimed. Thus, the combination of Imai and Ghozeil fails to produce the invention claimed in claim 1.

Moreover, the combination fails to achieve the objective of reducing the number of signal lines to the printhead.

Applicant submits that none of the cited references, either individually or in combination, teach or suggest the novel features of claim 1.

For the similar reasons as discussed above, Applicant submits that independent claim 10 is also patentable.

Dependent claims 2-4, 6-9 and 11-12 are also patentable by virtue of their dependency from independent claims 1 or 10.

Based upon the above amendments and remarks, Applicant respectfully requests reconsideration of this application and its earlier allowance. Should the Examiner feel that a telephone conference with Applicant's attorney would expedite the prosecution of this application, the Examiner is urged to contact him at the number indicated below.

Respectfully submitted,

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